

ORIGINAL ARTICLE

Periodontal Status of Tuberculosis patients - Inter linked with each other

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ABSTRACT

Background: Evidence suggests periodontitis may contribute to the development and progression of respiratory illnesses. However, few studies currently look at the coexistence of periodontitis and tuberculosis. The current study investigates the relationship between periodontal health and tuberculosis.

Aim: To assess various clinical dental parameters of periodontal health among patients with and without TB.

Methods: The participants in the present case-control study were individuals who obtained informed permission forms to participate when they were patients in the outpatient dentistry department. The current study included 585 patients in total. Three hundred-one individuals with normal pulmonary function were added to the control group, whereas 284 patients with tuberculosis were added to the cases group. The diagnosis of the pulmonary conditions was confirmed using spirometry. Using SPSS software 21, we evaluated the demographics & clinical indicators such as plaque, different gingival parameters of periodontitis, Gingival bleeding, and gingival index (GI), and compared cases and controls.

Results: The population comprised two hundred eighty-seven women (49.1%) and 298 men (50.9%). There was a significant association between tuberculosis and periodontitis, and it has been observed that 159 (56%) tuberculosis patients had 6.23 (4.2 – 9.1) times higher effects on oral periodontitis issues ($P < 0.001^*$). Patients with gingivitis had a significantly higher number of bleeding, accounting for 241 (72.8), $p < 0.001$.

Practical implication: The study suggests that healthcare providers, particularly those involved in the treatment of TB, should consider incorporating oral health screening and assessment as part of the overall care for TB patients. This could help identify and address periodontal issues that may exist, hence dental professionals can play a role in the early detections of TB

Conclusion: This study suggest that important relationship between TB and periodontitis. TB patients should be educated about the potential impact of their disease on periodontal health and encouraged to maintain regular dental visit and oral hygiene.

Keywords: Tuberculosis (TB), Periodontitis (PD), Gingival bleeding, and gingival index (GI)

INTRODUCTION

Periodontal disease is a widespread infectious and inflammatory disease of teeth-supported structures¹. The early stages of periodontal disease, gingivitis, are entirely reversible, but if not treated, they can progress to severe forms, periodontitis, which often leads to tooth loss. As a result, cognitive and speech impairments, poor nutrient status, reduced quality of life, and periodontal diseases are linked to the risk of some life-threatening systemic diseases (diabetes, cardiovascular disease, adverse pregnancy outcomes) have been reported, making the problem of global public health a significant concern. Population-based surveillance of periodontal diseases is essential for adequate planning, implementation, and evaluation of prevention and control programs. A clinical periodontal examination is the gold standard for detecting early signs of periodontal disease^{1,2}. Periodontal clinical examination is expensive, time-consuming, and requires specially trained personnel^{3,4}.

The transmissible and often austere airborne disease is caused by infectious bacteria, commonly called Tuberculosis (TB)⁵. It affects many parts of the body and especially the lungs. The treatment of TB is taken from 6 months to 2 years using different kinds of regime drugs, and it depends on the severity disease of the infection⁶. Inhaling respiratory droplets from an infected person coughing, sneezing, or speaking is the primary way TB is spread⁷. But not everyone who comes into contact with TB bacteria will go on to have active TB disease. Many TB patients will have a latent infection, which means that although the bacteria are present in their bodies, they do not exhibit any symptoms and are not contagious. Age, immunological function, and concomitant conditions like HIV infection or diabetes all affect the likelihood of acquiring active TB disease from a latent infection⁸. Additionally, some groups are more vulnerable to contracting TB, such as those who smoke, live in cramped or poorly ventilated spaces, or work in healthcare environments where TB patients are present⁹.

The burden of infectious diseases like TB, which accounts for 47% of all disease burden and is expected to climb by 69% by 2025, is disproportionately high in low-income nations.¹ Due to a lack of resources to combat the epidemic, TB has significantly increased mortality over time¹⁰. Mycobacterium tuberculosis is the bacterium that causes the infectious illness tuberculosis (TB). With a projected 10 million infections and 1.5 million deaths worldwide from TB in 2020, the disease is a global health concern. TB and poverty are closely linked to each other. Combine this with a lack of access to good quality health services, and the effects of TB are further exacerbated.¹¹ As they are closely linked, it becomes increasingly difficult for public health departments to deal with these communicable and non-communicable diseases.

Systemic factors modify periodontitis, principally affecting the standard immune and inflammatory mechanism, and periodontal disease has been associated with several systemic diseases. Repeated focal and long-term remission with decreased exacerbation has been noticed in periodontics patients suffering from pulmonary TB compared with patients without TB.

Studies on the clinical oral indicators of periodontal health in TB and non-TB patients are scarce. The immune system is known to be impacted by TB, which increases the risk of periodontal disease. People with TB have a higher prevalence of periodontal disease and more severe periodontal damage. The length of the TB infection and the degree of lung involvement are related to the severity of periodontal disease. However, patients with tuberculosis may be at increased risk of periodontal disease and more severe periodontal destruction. Dental examinations should be included in TB patients' routine care to evaluate their periodontal health and give appropriate therapy if necessary. The periodontal status also seems to be compromised in patients with TB owing to several factors, such as poor living conditions, low socioeconomic status, low native resistance and compromised host response from the debilitating or immunosuppressed condition.

Therefore, the present case-control observational study aimed to assess oral and periodontal status in TB patients.

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METHOD

Study method: The patient's periodontal condition was assessed with the help of OHI, PPD, and CAL. The periodontal health was evaluated by measuring the PPD from the crown of the gingival margin to the base of the periodontal pocket and the CCAL from the connection of cemento-enamel to the base of the periodontal pocket using the WHO CPI probe. The six surfaces of the teeth (distofacial, facial, mesiofacial, mesiolingual, lingual and distolingual) were examined to measure the loss of the dental pocket and attachment.

Population: With and without Tuberculosis target population

Sampling: Non-Probability Consecutive Sampling technique.

Sample size: With 5% statistical significance level (α), 80% power of test ($1 - \beta$), 43.8% of the real difference between two group effect (d), 10% of a clinically acceptable margin (δ_0), and 62.5% of response rate of high placement group (p) i.e., periodontitis in TB groups. Sample size of the study was calculated using sample size calculation formula for clinical superiority design and help from previous published study by Sharma, Anamika et al³. Sample size of n=512 patients stratified in to each groups with the ratio 1:1 for each for the with and without TB group was calculated. By adjusting 1.2 effect size then the total of A total of N= 284 +301 = 585 patients was needed for this study.

Data Collection: A Case-control study was conducted at a private dental clinic from 10/3/22 to 24/2/23. The cases (patients diagnosed with tuberculosis) and controls (fulfilling the inclusion criteria were identified). The cases were referred from the TB ward of Sindh Government Hospital Murad Memon Goth Malir. The purpose of the study was explained to the participants. Before beginning the interview and oral examination, verbal consent was taken from participants, with the assurance that anonymity will be maintained throughout the study. Patients in the age group of 12–70 years diagnosed with TB who had two or more teeth present in a sextant but weren't recommended for extraction met the inclusion criteria. Controls were matched on age, gender and socioeconomic status. They were referred from the orthopedic OPD of the same hospital.

Excluded from the study were natural teeth with full coronal restorations and teeth that had lost height due to caries or trauma. Patients on corticosteroids within 3-6 weeks before the application of the study. The patients who had undergone any surgical procedure 3- 6 months before the study. Edentulous ridge patients, smoking or any tobacco/ drugs and alcohol abuser users. Pregnant or Lactating females and those having psychological disorders were also excluded from the study. Consecutive (non-probability) sampling was used to enlist participants. The patient's periodontal condition was assessed with the help of OHI, PPD, and CAL. The periodontal health was evaluated by measuring the PPD from the crown of the gingival margin to the base of the periodontal pocket and the CCAL from the connection of cement enamel to the base of the periodontal pocket using the WHO CPI probe. The six surfaces of the teeth (distofacial, facial, mesiofacial, mesiolingual, lingual, and distolingual) were examined to measure the loss of the dental pocket and attachment. Except for the third molar, all teeth in the mouth were examined, and all teeth above 3mm deep in the pocket were considered of disease. For each tooth, the pocket depth was calculated at six locations, and the average value was considered the average pocket depth of the tooth.

Similarly, the average depth of the pocket for all teeth was calculated. The average pocket depth of all diseased teeth was calculated and was considered to be the average pocket depth of this individual. The average CAL was calculated in the same way. The expert technician recorded lung function, and the primary researcher recorded edits from the patient's medical file on the same day.

Statistics analysis uses version 17.0 of SPSS Inc.. Descriptive analysis was done for the demographic variables. A P value of less than 0.05 is considered statistically significant. Associations between different variables were taken out through

Chi Square test. Odds ratio interpreted with confidence interval and P value was used for finding association between Tuberculosis and Periodontitis.

RESULTS

Five hundred eighty-five patients' total—284 cases and 301 controls—were the subjects of the data collection. All patients were between 18 and 70, with a mean age of 42.63±12.35 years. Two hundred eighty-seven women (49.1% of the studied population) and 298 men (50.9%) comprised the population. Most of them took metric education, accounting for 200(34.2%), which is followed by 161(27.5%) who were illiterate, 128(21.9%) were primary, 89(15.2%) were graduates, and only 3 (0.3) were postgraduate. 241/585 accounted for 41.2 had monthly income between 20,000 - 30,000 PKR. Table-1 shows demographic information about individuals based on their periodontal health.

Comparison between cases and controls by different parameters of periodontitis are given in Table 2. The mean value for PPD (Probing Pocket depth) (mm) and Bitewing x-ray finding (periodontitis) was higher in cases groups (patients suffering from TB) group with a mean score of 3.2±2.07, 1.0±0.1 respectively, as compared to the control group with a mean score of 2.8±1.03, and 1.0±0.0, respectively. The difference between the groups for these parameters showed statistical significance with $P < 0.001$. The average value of the height of the Jaw bone (mm) was found to be significantly higher in the control groups, 15.5±3.9 vs. 16.6±2.9, $<0.001^*$; there was a significant association of patients with periodontitis found to be higher in cases groups with [159(56%) vs. 51(16.9%), $p < 0.001^*$], On the contrary, much more patients with gingivitis belonged to the control group than the case group, with 83(29.2%) vs 248(82.4%), $P < 0.001^*$ respectively. Patients with gingivitis had a significantly higher number of bleeding, accounting for 241(72.8%), $p < 0.001$. The evaluation of periodontal gingivitis index was comparable between gingivitis present and absent groups diagnosed with substantial gingivitis index II [204(61.6%) vs. 120(47.2%), $P < 0.001^*$] (Table-3).

Table-4 showed the significant association between tuberculosis and periodontitis, it has been observed that 159 (56%) tuberculosis patients had 6.23 (4.2 – 9.1) times higher effects on periodontitis oral issues ($P < 0.001^*$).

Table 1: Patient's characteristics

Parameters	n	(%)
Cases	284	(48.5)
Controls	301	(51.5)
Gender		
Male	298	(50.9)
Female	287	(49.1)
Education		
Illiterate	161	(27.5)
Primary	128	(21.9)
Matric	200	(34.2)
Graduate	89	(15.2)
Postgraduate	2	(0.3)
Monthly income (Rupees)		
<20,000	104	(17.8)
20,000 - 30,000	241	(41.2)
30,001 - 40,000	138	(23.6)
>40,000	98	(16.8)

Table 2: Association between cases and controls for different parameters

Parameters	Cases	Controls	p-values*
Patients with periodontitis	159(56%)	51(16.9%)	<0.001
Patients with Gingivitis	83(29.2%)	248(82.4%)	<0.001
Probing Pocket depth(mm)	3.2±2.07	2.8±1.03	0.001
Height of Jaw bone (mm)	15.5±3.9	16.6±2.9	<0.001
Bite wing x-ray finding (periodontitis)	1.0±0.1	1.0±0.0	0.025

*Chi- Square test

Figure 1: Association between cases and controls patients with periodontitis

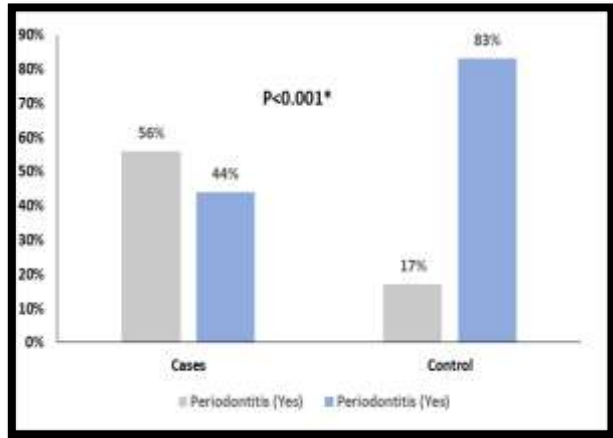


Table 3: Association of gingival bleeding and GI index among patients presenting without and without gingivitis

Parameters	Patients with Gingivitis		P value
	Yes n (%)	No n (%)	
Gingival bleeding	241 (72.8)	156 (61.4)	0.003*
Gingival index (GI)			
0	19 (5.7)	17 (6.7)	<math>< 0.001^*</math>
1	76 (23.0)	46 (18.3)	
2	204 (61.6)	120 (47.2)	
3	32 (9.7)	71 (28.0)	

*Chi- Square test

Table 4: Association of periodontitis by tuberculosis (TB)

Parameters	TB	
	Yes n =284(%)	No (n=301) (%)
Periodontitis		
Yes	159 (56%)	51 (18%)
No	125 (44%)	250 (88%)

P value <math>< 0.001</math>

Odds ratio (95% CI): 6.23 (4.2-9.1)

DISCUSSION

PD is a chronic gingival inflammatory process that destroys structures that support the teeth and alveolar bone and causes tooth loss due to bacterial infection. PD increases the risk of suffering systemic diseases, specifically respiratory infections.¹²The association between tuberculosis and PE in terms of PD involves chronic aspiration of bacteria from the oropharynx to the lower respiratory tract. Several studies show the association between PE with bacterial pneumonia, bronchitis, COPD, and lung abscess^{12,13}.

Those patients suffering from tuberculosis that affected periodontal condition were recruited as cases. Since all the enrolled hospital patients shared a similar socioeconomic status (poor) and practiced daily brushing with a toothbrush and toothpaste, such factors were not considered confounding variables in this study. To avoid bias, age and gender matching was done among the controls (number of medically healthy individuals). According to studies by Parashar Pet al., there may be a link between poor dental health and COPD even after accounting for other confounding variables, including smoking, age, gender, and sex¹⁴.

The objective of this research was to assess the various clinical dental parameters of periodontal health among patients with and without TB of a group of gingivitis+ and gingivitis - patients with pulmonary tuberculosis. We included 585 patients, 284 (Cases), and 301 (Control).

There is a 2 step process involved to develop an active form of TB. First, there is the first exposure to the disease and the infection by mycobacterium, which is airborne, and then the next advancement to the disease. TB is an infectious disease caused

by bacteria from Mycobacterium; Mycobacterium tuberculosis. It is the most frequent¹⁵. According to the World Health Organization, TB is latent in one-third of the World population and is the world's number one cause of death of infectious origin, with 1.4 million deaths in 2015¹⁶. TB should always be considered a possibility in studying oral cavity lesions, especially in endemic areas and underdeveloped countries, such as Pakistan, where TB remains a public health problem. Predisposing factors such as a history of TB, chronic bronchitis, neoplasms, diabetes, HIV, alcoholism, and drug addiction are equally important to consider in patients suspected of suffering from TB¹⁶. Numerous research has attempted to link periodontal disease to tuberculosis, but the findings have been contradictory^{1,3-5,7,14}. Studies have previously been proposed that link periodontal disease to a range of systemic ailments, including diabetes mellitus¹⁷, coronary artery disease¹⁸, stroke, and respiratory illnesses¹⁹.

There is, however, a dearth of evidence demonstrating a connection between TB and periodontitis. This study was carried out to evaluate the periodontal health of both TB-positive and TB-negative patients. When compared to the non-TB participants, it was found that these subjects had poorer periodontal disease. The cause of this could be related to the poor systemic health of these individuals, which results in poor oral hygiene upkeep and reduced availability of dental treatment. Some studies showed a link between periodontitis and TB. These results demonstrate endogenous poisoning and an imbalance in the lipid peroxidation system in patients with localized pulmonary TB.

According to the study by Aluru et al²⁰, those suffering from tuberculosis are significantly more likely to develop periodontal diseases that may be related to their immuno-compromised state. However, a few studies contradict the present finding, which found no significant association between periodontal health and length of illness. It also showed that the patient's TB status did not affect periodontal health^{1,3,6,13,21}.

As for the oral lesions found in these patients, all presented in the periodontium under the clinical forms of gingivitis, and some pictures suggestive of periodontitis, which is interesting if the literature is reviewed since several authors point out that tuberculous ulcer in the oral cavity is the most common lesion product of this disease, usually described as primary manifestation^{2,3,5,6,8}.

Saliva and plaque from TB patients with periodontitis have been found to contain Mycobacterium TB²². According to a recent study conducted in India, periodontitis is highly prevalent in those with tuberculosis between the ages of 51 and 60, particularly in men²³. However, no research has looked into the effects of periodontal conditions on the results of TB in the lungs.

It is thought that TB and periodontitis have a similar pathogenesis that ultimately leads to connective tissue damage. If these findings are supported by other prospective studies with bigger sample sizes, it will be possible to plan dental treatment for TB patients. The authors believe this study will also encourage and support future functional studies that will provide fresh perspectives on the pathogenic mechanisms behind the association between periodontal health and Pulmonary tuberculosis.

CONCLUSION

It can be concluded that periodontitis and TB have a significant association. The risk factors and patient education about the risk must be assessed to determine successful preventative measures. These findings indicate the potential value of encouraging good oral hygiene in preventing and treating tuberculosis.

Recommendation: While evidence supports the relationship between TB and periodontal disease, further study is required to fully understand the relationship and develop appropriate treatment guidelines for TB patients with periodontitis.

Conflict of interest: Nil

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